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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/726,752	11/30/2000	Hong Jongill	1115.64887	1886

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EXAMINER

UHLIR, NIKOLAS J

ART UNIT	PAPER NUMBER
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1773

2

DATE MAILED: 03/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/726,752

Applicant(s)

JONGILL ET AL.

Examiner

Nikolas J. Uhler

Art Unit

1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 January 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) none is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☒ Claim(s) 7 is/are objected to.
- 8) ☐ Claim(s) none are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4 93
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 1-10 in Paper No. 7 is acknowledged. Per applicant's instructions in this paper, claims 11-14 have been cancelled.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Objections

3. Claim 7 objected to because of the following informalities: In the instant case, claim 7 recites "the magnetization of said pinned magnetic layer and the magnetization of said free magnetic layer in opposite directions between the magnetizations." This phrase utilizes improper English. Specifically, "between the magnetizations" is redundant, as the applicant earlier in the phrase already requires orienting the magnetization of the free layer and the magnetization of the pinned layer in opposite directions. Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. (US5897969).

6. Regarding claim 8, wherein the applicant requires a magnetoresistive film comprising a pinned layer, a non-magnetic middle layer having a thickness of 34 angstroms or less on the pinned layer, a free magnetic layer on the non-magnetic middle layer, and a coupling layer for exerting a coupling field for directing the magnetization of the pinned layer and the magnetization of the free layer in opposite directions between the magnetization is formed on said free magnetic layer.

7. Regarding these limitations, Hayashi et al. (hereafter Hayashi) teaches a magnetoresistive head comprising a fixed layer 24 (equivalent to applicants pinned magnetic layer), a barrier layer 25 formed on the fixed layer, a free layer 26 (equivalent to applicants free magnetic layer) formed on the barrier layer, and a biasing layer 27 (equivalent to applicants claimed coupling layer) (column 7, lines 10-15 and figure 3a). While Hayashi does not specifically teach that the barrier layer is non-magnetic, Hayashi does teach that suitable materials for the barrier layer include films of oxides or nitrides of Ti, V, Al, Zn, Y, Zr, Nb, Mo, etc... (column 9, lines 24-30). Many of these materials, such as Aluminum or titanium oxide, are known to be non-magnetic.

8. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a non-magnetic material as the barrier layer in Hayashi.

9. One would have been motivated to make this modification due to the teaching in Hayashi that known non-magnetic materials such as TiO_2 and Al_2O_3 are equivalent to the other materials listed as suitable for the barrier layer.

Art Unit: 1773

10. The applicant is respectfully reminded that substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In Re Fount* 213 USPQ 532 (CCPA 1982); *In Re Siebentritt* 152 USPQ 618 (CCPA 1967); *Grover Tank & Mfg. Co. Inc V. Linde Air Products Co.* 85 USPQ 328 (USSC 1950)

11. Regarding the limitation in claim 8 that requires the coupling layer to exert a coupling field for directing the magnetization of the pinned layer and the free layer in opposite directions. It is noted that Hayashi teaches that the biasing layer exerts a bias field on the free layer to control the magnetic domain of the free layer (columns 7 and 8, lines 54-6). Further, Hayashi teaches that sensitivity of a magnetic head incorporating a free layer and a pinned layer can be improved by orienting the magnetizations of these two layers perpendicular to one another (columns 1 and 2, lines 62-5).

12. Therefore, it would have been obvious to one of ordinary skill in the art to orient the magnetization of the free layer and the pinned layer in Hayashi to be perpendicular to one another, in light of the teaching in Hayashi that doing so improves sensitivity.

13. Claims 1-6 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi et al. (US6490139) in view of Taniyama et al. (US5897969).

14. Regarding the limitations of claim 1, wherein the applicant requires a magnetoresistive film including a pinned magnetic layer, a non-magnetic middle layer on the pinned layer, a free magnetic layer on the non-magnetic middle layer, and a copper oxide layer of an oxide including a copper element is formed directly on the free magnetic layer or on the free magnetic layer via an oxide layer comprising a material fabricated by oxidation of a material constituting the free magnetic layer.

Art Unit: 1773

15. For the purpose of this examination, the examiner interprets the term "including" in the second line of the claim to allow the magnetoresistive film to comprise other layers besides the ones specifically required by the claim.

16. With respect to these limitations, Hayashi teaches a magnetoresistive head comprising a fixed layer 24 (equivalent to applicants pinned magnetic layer), a barrier layer 25 formed on the fixed layer, a free layer 26 (equivalent to applicants free magnetic layer) formed on the barrier layer, and a biasing layer 27 (column 7, lines 10-15 and figure 3a). While Hayashi does not specifically teach that the barrier layer is non-magnetic, Hayashi does teach that suitable materials for the barrier layer include films of oxides or nitrides of Ti, V, Al, Zn, Y, Zr, Nb, Mo, etc... (column 9, lines 24-30). Many of these materials, such as Aluminum or titanium oxide, are known to be non-magnetic.

17. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a non-magnetic material as the barrier layer in Hayashi.

18. One would have been motivated to make this modification due to the teaching in Hayashi that known non-magnetic materials such as TiO_2 and Al_2O_3 are equivalent to the other materials listed as suitable for the barrier layer.

19. The applicant is respectfully reminded that substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In Re Fount* 213 USPQ 532 (CCPA 1982); *In Re Siebentritt* 152 USPQ 618 (CCPA 1967); *Grover Tank & Mfg. Co. Inc V. Linde Air Products Co.* 85 USPQ 328 (USSC 1950)

~~20. With respect to the biasing layer, as shown in figure 3a, the biasing layer 27 is~~
directly in contact with the free layer. Further, Hayashi teaches that suitable materials

Art Unit: 1773

for forming the biasing layer include NiO, NiCo oxide, FeOxide, etc... (column 9, lines 35-40). It is specifically noted that Hayashi teaches that the biasing layer applies a biasing magnetic field to the free layer in order to cause the free layer to have a stable magnetic domain (column 7, lines 60-67).

21. However, Hayashi does not teach utilizing a CuO layer directly in contact with the free layer.

22. With respect to this deficiency, Taniyama et al. (hereafter Taniyama) teaches that CuO and NiO are equivalent for use as a magnetic domain controlling film in a magnetic head (column 14, lines 53-55).

23. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize CuO as taught by Taniyama as the biasing layer 27 utilized in Hayashi.

24. One would have been motivated to make this modification due to the teaching in Hayashi that NiO is suitable for use as the biasing layer, and the teaching in the Taniyama that CuO is equivalent to NiO for use as a magnetic domain controlling film (which is the same function of the biasing layer in Hayashi).

25. While the examiner acknowledges that the Taniyama reference only teaches placing the magnetic domain-controlling layer between a substrate and a magneto resistive film, the examiner is not relying on Taniyama for any structural teachings. Rather, the examiner is merely relying on Taniyama to establish that one of ordinary skill in the art at the time the invention was made would have recognized the equivalence of CuO to NiO as magnetic domain controlling materials.

Art Unit: 1773

26. Regarding claims 2-3, wherein the applicant requires the CuO layer to have a thickness $>5\text{nm}$, more specifically $>10\text{nm}$. It is noted that although Hayashi does not teach a general thickness range for the biasing layer, Hayashi does teach specific embodiments wherein the biasing layer is $>10\text{nm}$. Specifically, Hayashi teaches examples wherein the biasing layer is 36nm (column 26, lines 33-36), 50nm (column 31, lines 58-65), and 500nm thick (column 33, lines 5-10).

27. Therefore, in light of these examples, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the CuO biasing layer utilized by Hayashi as modified by Taniyama to a thickness $>10\text{nm}$.

28. Regarding claims 4-6, wherein the applicant requires a protective layer of Al_2O_3 to be formed on the CuO layer. It is noted that Tanahashi teaches forming an insulating layer 28 overtop the biasing layer 27. Suitable materials for forming insulating layer 28 include Aluminum oxide (Al_2O_3) and other materials (column 9, lines 40-45).

29. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize Al_2O_3 as the insulating layer 28 formed over the biasing layer 27 in Hayashi in light of the fact that Hayashi teaches the equivalence of Al oxide to the other materials listed as suitable for this purpose.

30. Regarding claims 9 and 10, wherein the applicant a magnetoresistive head and a information regeneration apparatus comprising essentially the same limitations as claim 1. It is noted that Hayashi is specifically directed towards forming a magnetoresistive head (column 3, lines 33-35). Thus, the limitations of claim 9 are met. Further, it is noted that a data reading/writing device comprising the magnetic head discussed above in

proximity with a recording media is claimed by Hayashi (column 34, claim 8). Thus, the limitations of claim 10 are met.

31. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hayashi modified by Taniyama as applied to claim 1 above, and further in view of Kawawake et al. (US6245450).

32. With respect to claim 7, it is noted that Hayashi as modified by Taniyama above does not teach a free layer having a thickness of ≤ 30 angstroms.

33. However, with respect to this deficiency, Kawawake et al. (hereafter Kawawake) teaches that the thickness of a free layer in a magneto resistance device impacts the magneto resistance ratio (MR ratio) of the device. Specifically, as the thickness of the free layer is too thick, the MR ratio is reduced due to shunting. Further, if the thickness of the free layer is too thin, the soft magnetic properties of the Free layer are reduced (column 7, lines 58-65). Thus, the examiner takes the position that the free layer thickness in Hayashi as modified by Taniyama is a results effective variable.

34. Thus, in light of the above teachings, it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the thickness of the free layer in Hayashi as modified by Taniyama to a desired range in order to obtain a desired balance between free layer thickness, MR Ratio, and the soft magnetic properties exhibited by the free layer.

Conclusion

Art Unit: 1773


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.



nju
March 25, 2003



Paul Thibodeau
Supervisory Patent Examiner
Technology Center 1700